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**EXECUTIVE SUMMARY
FOR
THE MONTANA EDUCATIONAL
TELECOMMUNICATIONS PROJECT**

Prepared for:
STATE OF MONTANA
Mr. Dave Ashley, Director
Department of Administration

STATE DOCUMENTS COLLECTION

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July 12, 1990



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July 12, 1990

Mr. Dave Ashley
Director
STATE OF MONTANA
Department of Administration
Mitchell Building, Room 219
Helena, Montana 59620

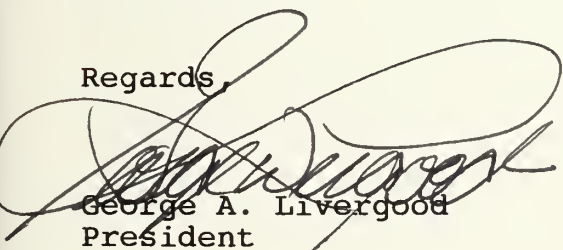
RE: Letter of Conveyance

Dear Mr. Ashley:

Please find included herewith one copy of a set of reports as the final deliverable in compliance with state of Montana Consulting Services Agreement dated 19 December 1989.

I know that I speak for all of the members of the Lambda Communications Inc. project team when I say that this has been both one of the most enjoyable and promising educational projects of any that we have had the privilege on which to work. If you have any further questions or concerns please call or write at the letterhead address.

Regards,



George A. Livergood
President

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EXECUTIVE SUMMARY

The courts and the legislature agree that educational opportunities for Montanans are inequitably distributed. As an important part of House Bill 28, through which the 1989 Legislature addressed the issues of school equalization, the Department of Administration was funded to retain consulting assistance to design a network through which all Montana schools and other organizations might have access to improved educational resources and to move to initial implementation of an agreed-upon network plan. The Office of Public Instruction and the Montana University System have worked closely with the Department of Administration throughout this project, which carries forward successful cooperative efforts begun through a Task Force on telecommunications established by the 1987 Legislature under House Joint Resolution 58.

To provide broad based policy guidance to the project and to carry forward cooperative educational network planning, the Montana Telecommunications Cooperative was formed in December 1989 with membership open to all Montana organizations, public and private, interested in educational networks. Nancy Keenan, Superintendent of Public Instruction, is Chair; Carrol Krause, Commissioner of Higher Education, served as Vice-Chair (replaced in July 1990 by John Hutchinson); Tony Herbert, Assistant Administrator of the Information Services Division, Department of Administration, is Secretary/Treasurer. A list of Cooperative Board members is appended.

The development of an educational telecommunications network for the state of Montana could not have come at a more opportune time. Montana educators are creatively demonstrating the value of computer-based data links to augment learning opportunities. Educational programming via satellite is becoming increasingly available while satellite hardware prices are decreasing. Existing telecommunications infrastructures throughout Montana are being upgraded to digital facilities while other areas are being even further upgraded to the ultimate telecommunications medium, fiber. Concurrent with these developments in transmission systems, incredible advances in video compression technology are making video transmission at cost effective data rates possible. All of these coincidental technological developments mean little, however, if the actual "needs" of the educational community are not first identified and considered as the basis for any resulting network design.

1.1 NEEDS ASSESSMENT

The Montana Educational Telecommunications Project included a very extensive questionnaire survey of the perceived needs of the educational community across the entire state; in addition, more than 125 meetings brought the project team in touch with over 1,000

Montanans. Although targeted for educators, private sector businesses and non-profit organizations also had opportunities to identify their training requirements. The data gathered served to establish the foundation for a long term network plan to support the educational requirements of the state at the K-12, post-secondary, and professional and job related levels.

The issue of "affordability" was the most common requirement of all potential originators and users of a Montana educational network. The proposed network solution evolved with this issue paramount. Key concerns raised during the Needs Assessment portion of the project include the following:

- Affordable network
- Geographically equal access
- ✓ Specialized training
- Teacher inservice training
- ✓ Adult Enrichment
- College credit courses
- ✓ Professional re-certification
- Reduce travel time
- Public-private sector participation

Concurrent with the issue of "affordability" was agreement that programming was needed immediately to supplement existing courseware. We have begun to identify programming already available in a variety of forms through terrestrial and satellite links and in video tape or computer programs which could support Montana learners soon.

1.2 TECHNOLOGY ASSESSMENT

Just as in the Needs Assessment portion of the project, a concentrated effort was made to identify and evaluate significant existing and proposed telecommunications resources in the state of Montana. This Technology Assessment provided the project team with the pieces of the puzzle which potentially have the capability to satisfy concerns raised during the Needs Assessment in a manner consistent with a reasonable prediction of future related technological trends.

Technological trends must include the reasonable assumption that within five years a marriage of technologies will occur which will allow a cooperative affordable delivery and exchange of information through voice, data and video on a statewide basis. The benefits of Montana based Big Sky Telegraph and Edunet will reach even more Montana schools. Telephone companies will expand their ability to cost effectively furnish interactive two-way television for education. Advances in the fields of computer technology and compressed video will result in quality transmissions of totally interactive video over a standard digitally switched voice grade telephone line. Nationally distributed educational training materials and resources

will continue to expand, giving small rural Montana schools access to programming and information which can only be acquired either directly or indirectly by satellite.

The five year plan, therefore, must include a multi-technology capability at each and every school in the state of Montana. In order for two-way interactive video to play a part in the future of education, it must be both affordable and geographically indiscriminatory. The first realization of this goal will likely be through digitally switched voice grade service using compressed video. But these advances will not support distance learning unless teacher inservice training is expanded to include preparation for use of these technologies. Teachers must be instructed in the use of computer links and one-way and two-way video, as methods of augmenting, not compromising the learning environment.

1.2.1 COMPRESSED VS. BROADCAST QUALITY VIDEO

Compressed video is a key element in the network plan we are proposing. Since compressed video can be carried over voice grade digitally switched telephone lines, it can be affordable for Montana -- even without waiting for fiber links to every school.

A particularly promising advance in video compression was given its public premiere in Helena in a Spring meeting of educators sponsored by Edunet. A subsequent review of this technology by both the project team and Montana educators found it acceptable in every respect. An even more promising aspect of this particular compression technology is that it is represented as able to be carried on standard digital voice grade telephone lines.

There is no question that the technology is here today to provide such a service. The alternative of broadcast quality video transmission requires over 800 times the bandwidth or transmission system carrying capacity of the compressed video. While both technically possible and widely used in video fiber applications, broadcast quality video cannot be reasonably considered as a part of a statewide Montana network solution, or even as a regional solution, because of its substantial costs.

1.3 NETWORK PLAN

Our recommended five-year plan of action has two key elements:

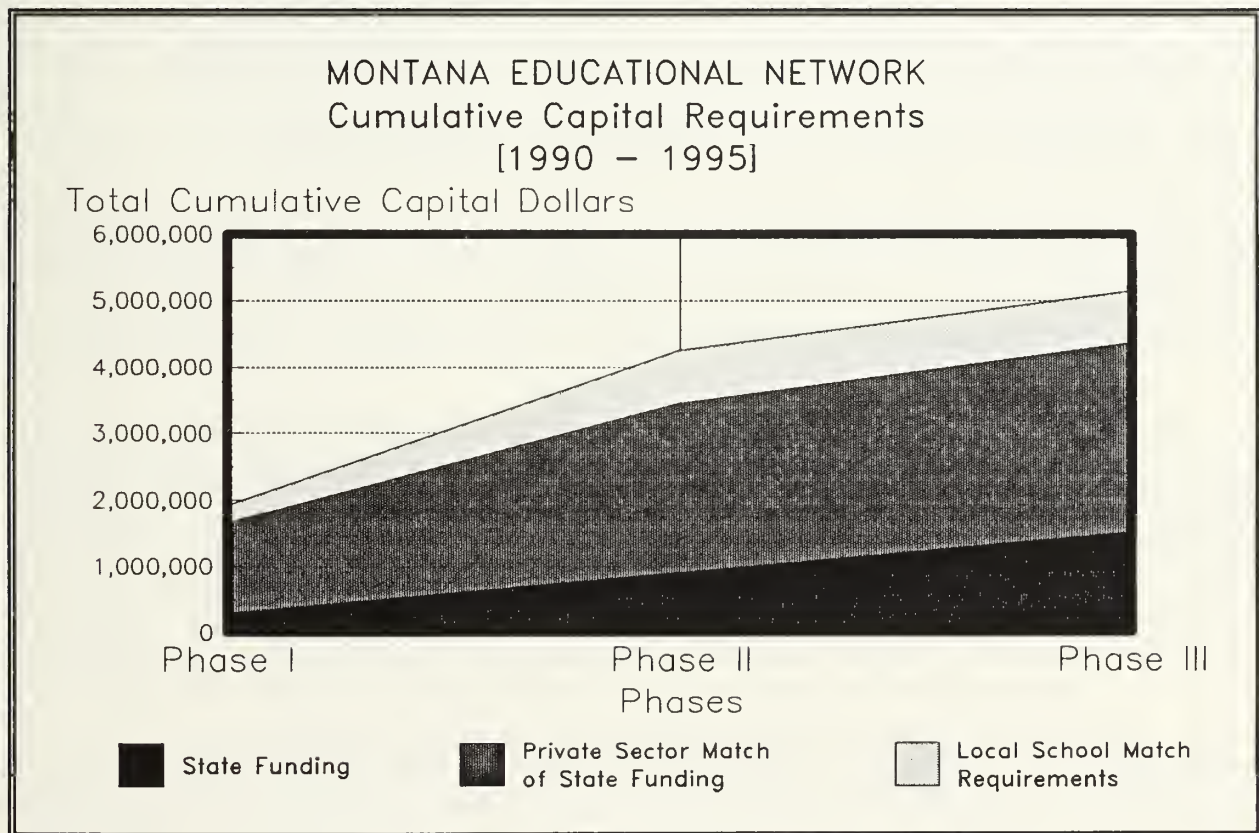
- Network Facilities
- Educational Programming

The design addresses these objectives:

- Affordability
- Geographically equal accessibility
- Multi-technology

The project plan is based upon an evolution towards a multi-technology capability for educational outreach in Montana. The plan begins with improved computer support and one-way video two-way audio to address the immediate needs of the schools as expressed in the Needs Assessment. Over a period of five-years, the network evolves into an interactive video system with a total of 66 sites (at least one in every county) served by terrestrial facilities, supplemented by one-way video to every school via satellite.

The total projected direct cost to the state of Montana is \$1.5 million, matched by an additional \$750 thousand from other sources. Of this total, \$300 thousand has already been appropriated by the 1989 Legislature, provided this is matched with \$150 thousand. Legislature should be prepared to fund further network implementation if the plan is agreed upon, requesting the same annual amount in each of the next two biennial sessions.



The five year plan is divided into three phases coincident with the state's biennial budget cycles with Phase I to be completed June 30, 1991, Phase II by June 30, 1993 and Phase III by June 30, 1995.

1.3.1 PHASE I

Phase I will be focused on applying the initial implementation funding to enhance existing networks on a statewide basis, and securing substantial private sector involvement.

1.3.1.1 NETWORK FACILITIES

By the end of the first year of network operation, we plan that there be in place:

- Modems to link personal computers to networks in all schools (approximately 800)

- At least 250 schools with C and Ku band satellite receive dishes, classroom telephone links, television sets and VCR's -- capable of participating in telecourses

- X*Press data service FREE to all schools

- Active regional two-way video networks

- Statewide access to an educational resource data base which includes programming and other supplementary instructional resources

Further, as part of a substantial contribution, we anticipate the donation to Montana of a Mobile C-band satellite uplink and of the satellite transponder time needed during school hours for a period of two years. This will supplement the Ku-band uplink recently put in place on the Montana State University campus, to support Montana origination of courses.

1.3.1.2 EDUCATIONAL PROGRAMMING

During this first phase, Montana computer based programming through Edunet and Big Sky Telegraph will continue to develop. Teacher training in the area of telecommunications may be conducted through either of these existing Montana resources. In order to avoid a duplication of effort in the Montana schools, Phase I of the project provides for the development of a centralized data base which will include all educational training resources which are available to any Montana educator for augmenting existing courseware.

Most video based programming in this phase will be obtained from outside-Montana sources; video programming similar to the Japanese telecourse currently being used by Montana students in Fairview, Montana.

1.3.2 PHASE II

Phase II will supplement the first year's construction efforts while expanding the teacher inservice training program.

1.3.2.1 NETWORK FACILITIES

It is recommended that the state work with the telephone service providers to accelerate the conversion of switches and links to digital facilities, and to integrate already developing in-Montana regional networks into a statewide network. By the end of the third year of network operations, we project that:

All Montana schools will be equipped with computer modems and with C/Ku satellite receive capabilities, classroom telephone links, television sets and VCR's, X*Press data service, and free informational programming to augment courseware

Six sites will be equipped with capabilities for two-way compressed video over terrestrial links

1.3.2.2 EDUCATIONAL PROGRAMMING

Schools making effective initial use of distance learning, and schools most likely to serve as Montana-originating program resources will be identified. Participating institutions will recognize the benefits of partnering in the development of needed course materials, especially in regional groups.

Teacher inservice training programs must be updated to keep pace with the changing applications of technology.

1.3.3 PHASE III

Phase III will be completed by July 1995.

1.3.3.1 NETWORK FACILITIES

Capabilities should be in place to support the transition to two-way interactive video transported over terrestrial digital networks, to at least one location in each of Montana's 56 counties. The budget supports these capabilities to be obtained from a telecommunications service provider.

Satellite communications will continue to be in widespread use primarily for specialized and supplementary informational programming.

1.3.3.2 EDUCATIONAL PROGRAMMING

Programming within Montana will continue to develop, not only for K-12 schools, but also for college credit courses, worksite training, re-licensure, programs for those with special learning needs, and programs supporting economic development.

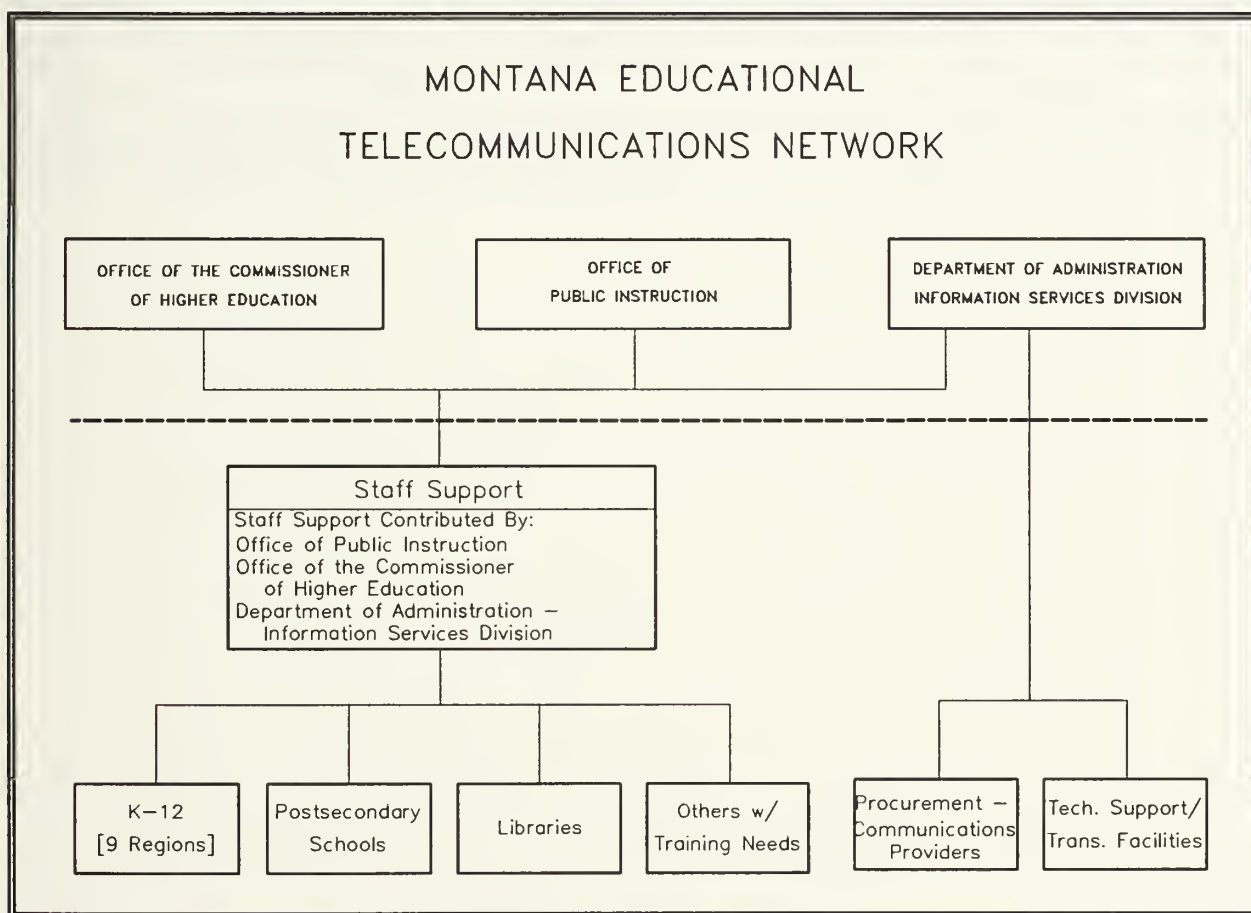
1.4 ORGANIZATION

We recommend that for operational planning and action for the network and programming, the three organizations which have coordinated this project continue to work together as lead agencies; the Office of Public Instruction, the Commissioner of Higher Education, and

the Information Services Division of the Department of Administration. These agencies will need to dedicate staff to the network implementation and education support, and key leaders from the agencies will need to meet frequently to coordinate these developments as high priority items on their individual agendas.

The Montana Telecommunications Cooperative and its Board should continue to meet regularly as a broad based forum for discussion of educational network development.

We recommend that the K-12 community utilize a structure similar to the regional organization of School Superintendents to provide local planning and input to the development. Similarly, for the post-secondary institutions, the Montana Education Commission for the 90's and Beyond has recommended 11 regional Higher Education Centers, through which local planning and input to the education network development can be channeled.



1.5 BUDGET

It is recommended that the state legislature continue to appropriate funds similar to those designated under HB28 in equal amounts as

initially granted; \$300 thousand per year with a 50% matching requirement. The total additional state funding for the five year project is \$1.2 million. Operating revenues for the network are proposed to be generated through a \$1 per FTE per year fee from each school as well as Usage Fees paid by originators of programs.

For purposes of this project it is assumed that the state of Montana will fund the construction of a network which will serve the educational needs of the state. These state funds will be matched by the private sector both initially as a minimum of a 50% match to trigger the annual funding and later as an additional local funding match to secure the funds for a specific user. A key factor in the legislation relative to the release of the initial state funding is the provision that any private sector matching funds raised in excess of the 50% minimum should also be required to be dedicated to the Montana Educational Network.

Operating costs will be paid by users in the form of nominal membership fees and originators of programming in the form of usage fees. It is not expected that the state will directly fund the costs of any operations. It is, however, expected that travel budget savings (if realized) through the use of the network, will become network revenues in the form of usage fees.

PROPOSED CAPITAL EQUIPMENT BUDGET						
Description	Qty	Cost Each	\$K Total Cost	\$K Local Cost	\$K State Funds	Notes 4
PHASE I FYE 30 JUNE 1991						
Satellite Receive Sites	250	1,800	450	190	260	1,2
Audio Return Equipment	250	350	88	38	50	1
Telephone Line Modems	800	60	48	0	48	
TV and/or VCR	150	600	90	28	62	
LPTV/Regional Applicants					?	3
Labor: Data Base Development					30	
Sub-totals					\$450	
PHASE II FYE 92/93						
Satellite Receive Sites	530	1,800	954	389	565	1,2
Audio Return Equipment	530	350	186	75	110	1
TV and/or VCR	350	600	210	75	135	
LPTV/Regional Applicants					?	3
Interactive Video via Terrestrial Facilities	6	15,000	90	0	90	
Sub-totals					\$900	
PHASE III FYE 94/95						
Interactive Video via Terrestrial Facilities	60	15,000	900	0	900	
Totals					\$900	
TOTALS					\$2,250	

NOTES:

1. Matching funds from schools are based upon a formula for Chapter 1 Schools whereby the state of Montana would provide funds at the ratio of 2:1; all other schools are funded on a 1:1 basis.

2. School districts bear all costs of shipping and installation. Volunteer labor could be used.
3. "Low Power/Regional TV applicants" is intended to refer to any regional provider of video programming to schools and includes the RTS as well as local providers of video services through coaxial cable or any other telecommunications means. Low Power/Regional TV applicants could utilize the designated state funds for those schools which they serve in their service area provided that:
 - A. Each school agrees;
 - B. The schools have the ability to request that at least one steerable C/Ku satellite antenna be installed and to be located on request to specific satellites and transponders as required for the school's programming needs; and
 - C. The schools understand and agree that their priority in the satellite dish installation schedule will be shifted lower since they will be receiving service via the local LPTV/Regional service provider.
4. The total "State Funds" figure includes the minimum of a 50% match from the private sector.

1.6 SUMMARY

By the year 1996 every school in the state of Montana will have access to additional educational programming directly through the satellite or indirectly through their local video service provider. Montana originated programming at both C and Ku band will be delivered on an as required basis serving to keep the per student costs as affordable as possible while using Montana state teaching resources. Regional telephone networks will allow the two-way exchange of teacher resources with expanded communication on a statewide basis as required. Private sector businesses will be actively using the distant education capability of the state colleges to enhance the employee benefits and extend both the average employee tenure and the overall quality of life for their personnel.

Although the Montana Telecommunications project will never be known for the creation of a totally new and dedicated educational network, it should establish a precedent for the economical enhancement, use, coordination and integration of existing telecommunications facilities. Even more importantly, the Montana project has clearly demonstrated the advantages of economic development through public/private sector participation.

Private sector support of the network during the first five years of network evolution is expected to generate an additional \$3 million in "in-kind" contributions. One Montana company alone has agreed to substantial "in-kind" support during the first five years before the project has even started.

The resulting proposed Montana Educational Network includes the following features:

- * Statewide access to an educational resource data base which includes programming and other supplementary instructional resources.
- * Statewide Ku Band satellite coverage utilizing the existing Ku Band uplink at MSU with satellite dish installations at every school.
- * Statewide C Band satellite coverage utilizing a commercial C Band uplink with satellite dish installations at every school.
- * Statewide data communications capability through the use of personal computer modems furnished for every school.
- * Statewide access to the state telecommunications network by all schools in order to reduce rates and increase the level of service in some cases.
- * Statewide educational informational programming via satellite (12 channels) with additional access to all C and Ku Band educational programming currently estimated at over twenty channels.
- * Statewide X*Press data service to all schools.
- * C Band transponder time for two years during the school hours of each school day.
- * Additional televisions and VCR's for 500 schools.
- * Additional audio origination equipment for 780 schools.
- * Two-way interactive video (compressed) facilities located at 66 locations with at least one location in each of the 56 counties.

1.7 ADDITIONAL GRAPHS AND ATTACHMENTS

Montana Educational Telecommunication Network Organizational Chart

Cumulative Capital Requirements Graph

Proposed Montana Educational Network Graph of Expansion

A Montana Educational Network Status - January 1, 1990

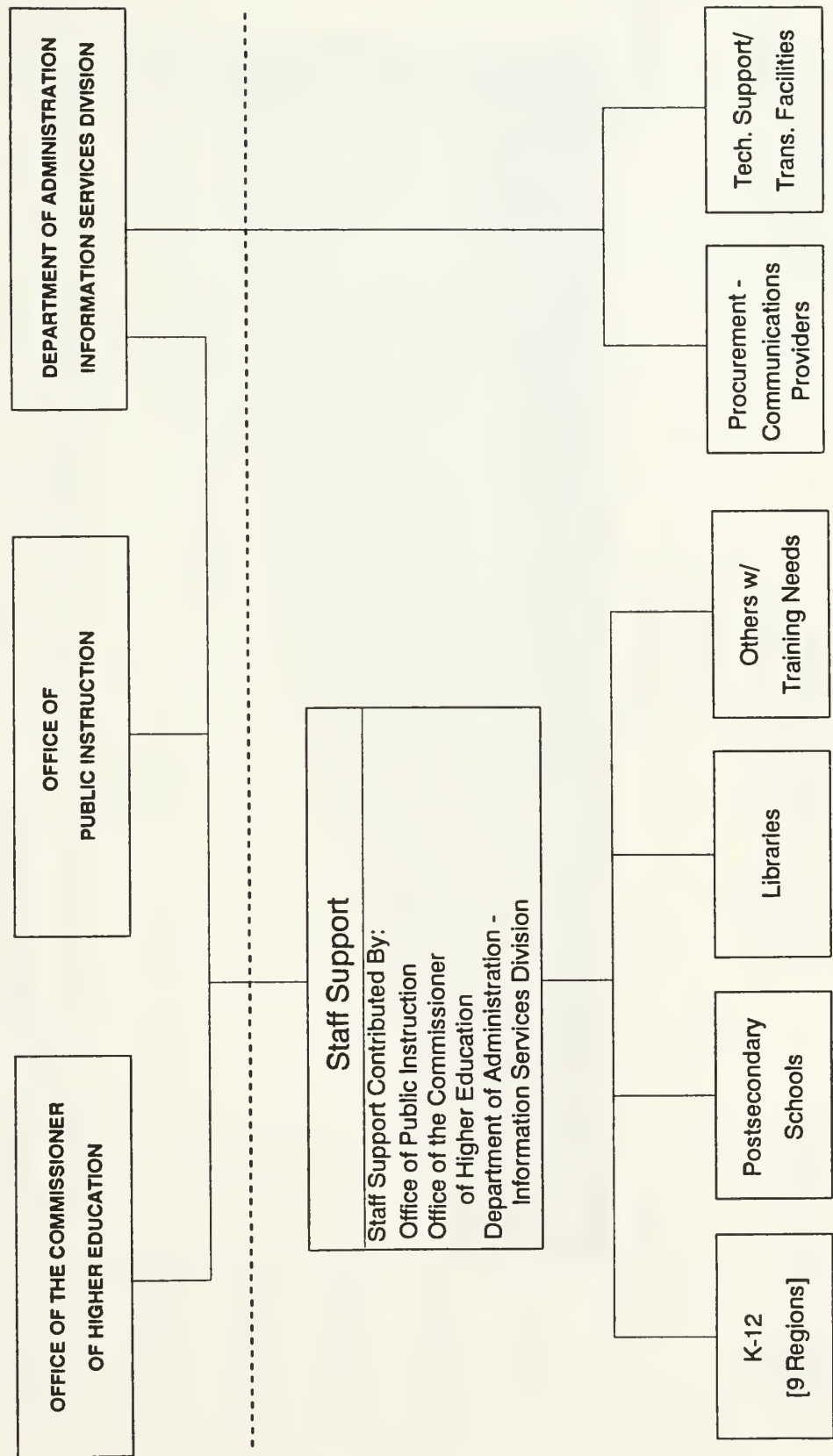
A Montana Educational Network Phase I Status - June 30, 1991

A Montana Educational Network Phase II Status - June 30, 1993

A Montana Educational Network Phase III Status - June 30, 1995

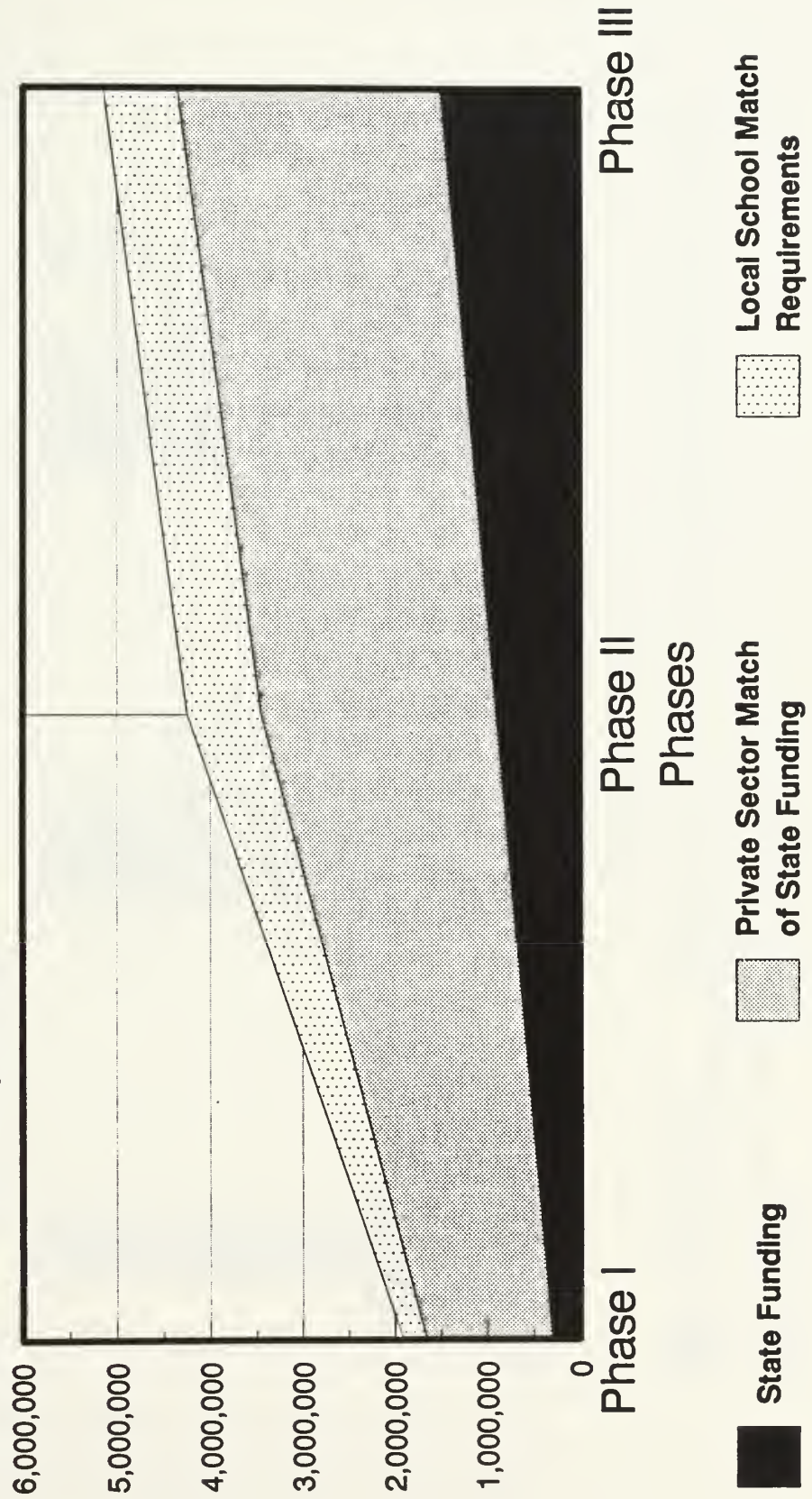
Montana Telecommunicatios Cooperative Board of Directors

MONTANA EDUCATIONAL TELECOMMUNICATIONS NETWORK



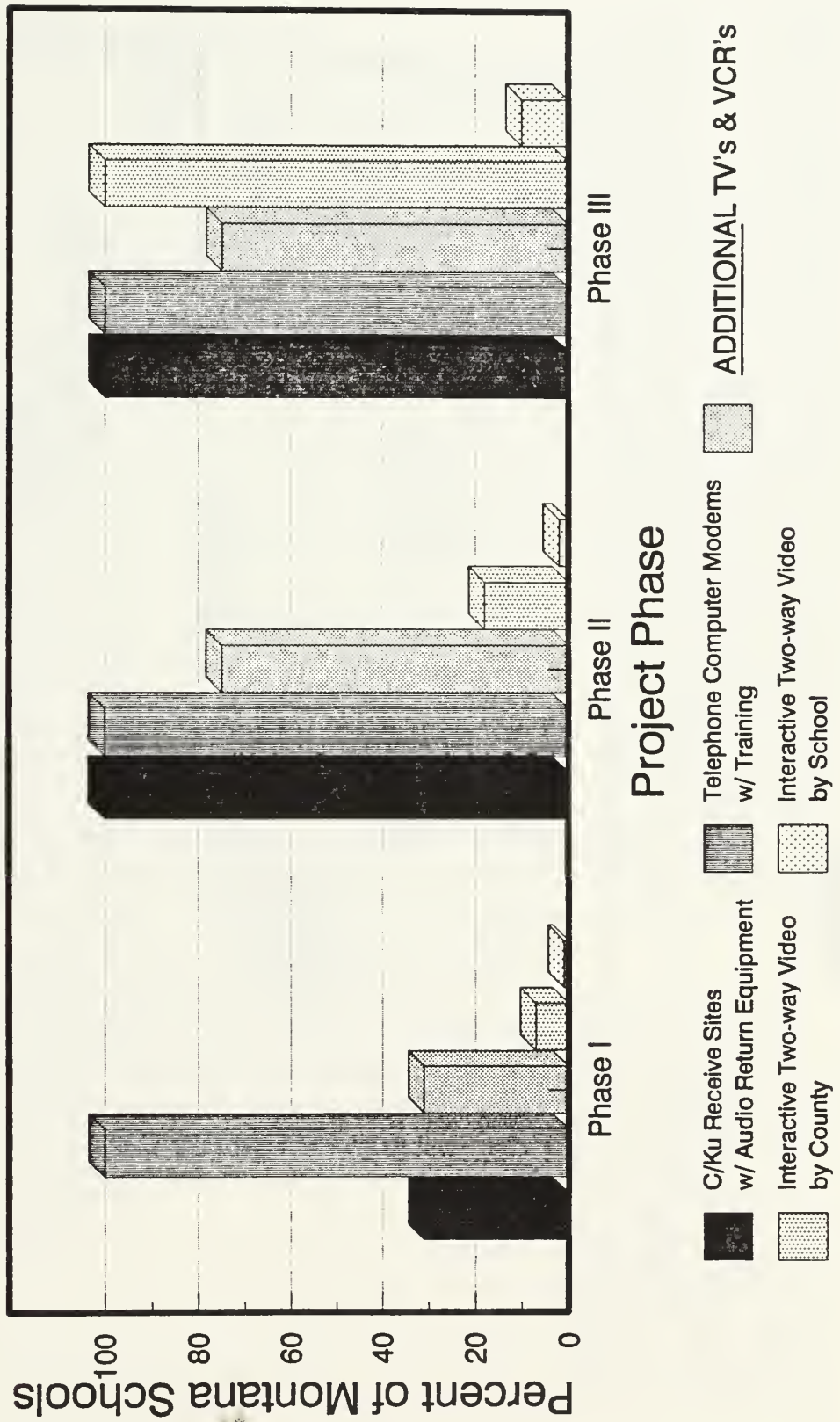
MONTANA EDUCATIONAL NETWORK **Cumulative Capital Requirements** **[1990 - 1995]**

Total Cumulative Capital Dollars



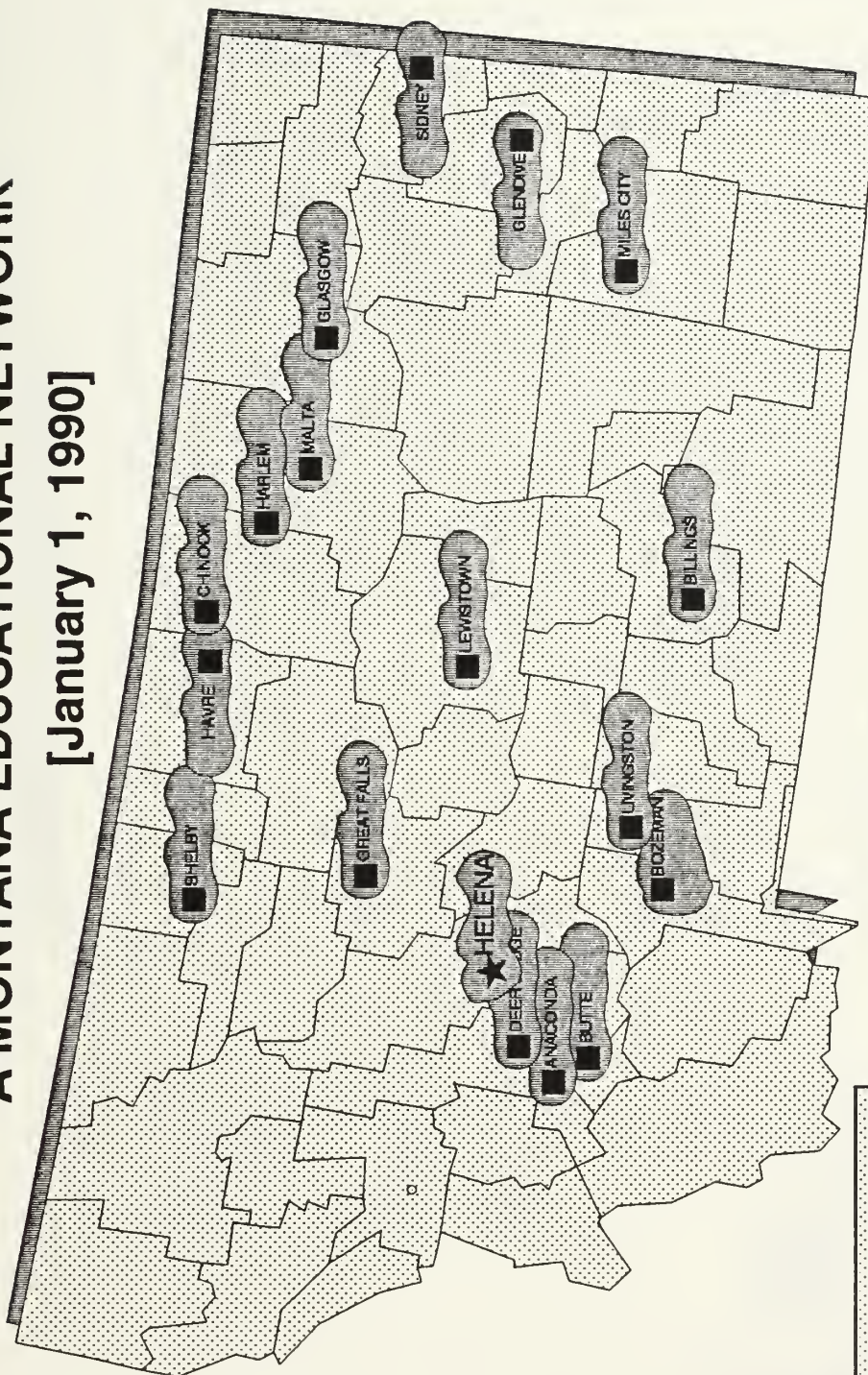
PROPOSED MONTANA EDUCATIONAL NETWORK

[1990 - 1995]



A MONTANA EDUCATIONAL NETWORK

[January 1, 1990]



STATEWIDE COVERAGE

Available Satellite Delivered Instructional & Informational Programming

Statewide Coverage by existing satellites but few installed downlinks

Access to Montana Data Networks [EDUNET, Big Sky Telegraph, Goliath]

Statewide Coverage through existing telephone systems

but few modems are installed in schools

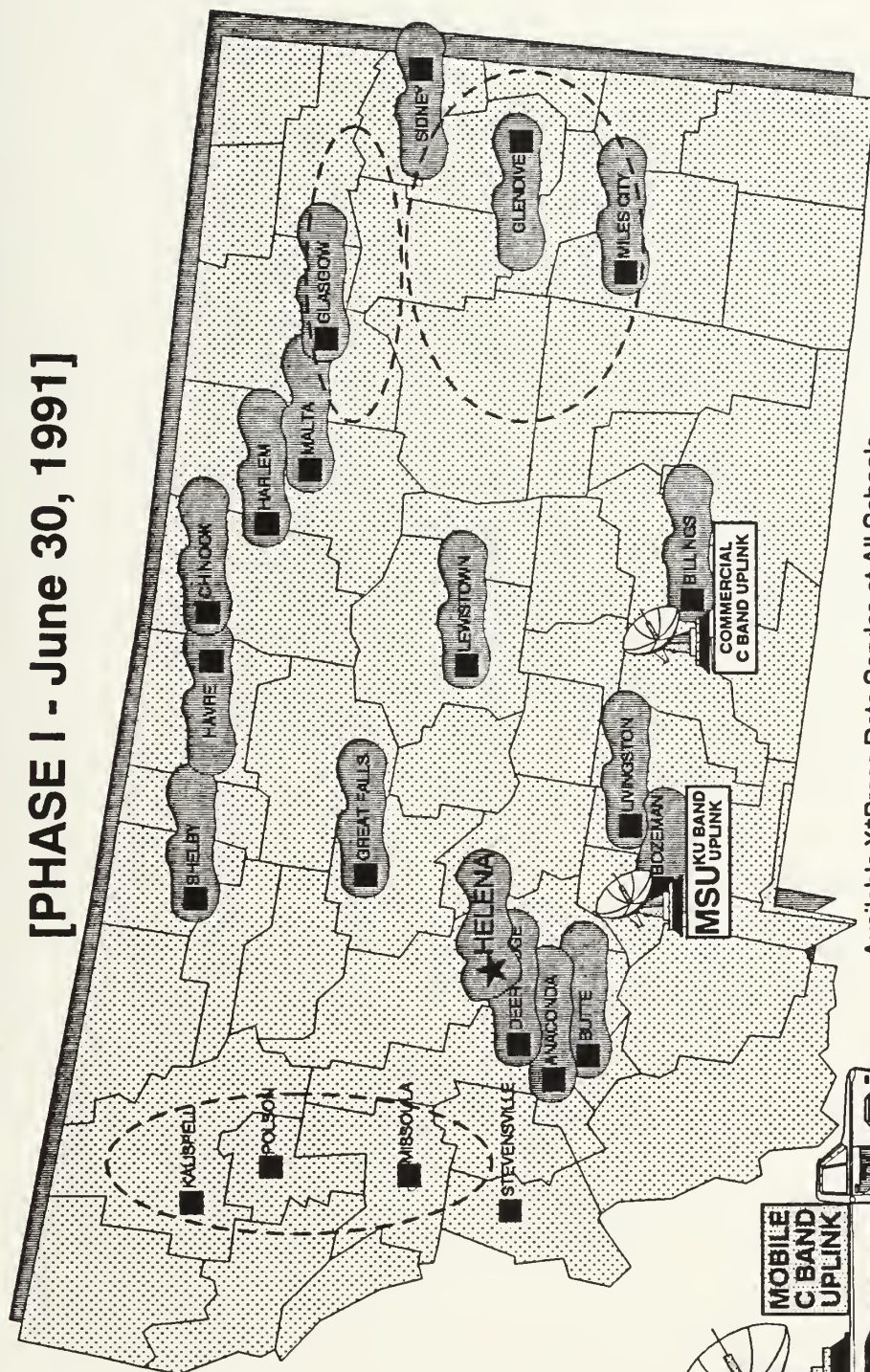
Existing PBS service areas although without an instructional programming

format and delivered primarily through cable television systems



A MONTANA EDUCATIONAL NETWORK

[PHASE I - June 30, 1991]



**STATEWIDE
COVERAGE**

Regional Interactive Video Projects

Available X*Press Data Service at All Schools

Access to FREE C Band Satellite Transponder Time

Available C Band uplink in Billings with microwave interconnect network

Access to Satellite Delivered Instructional & Informational Programming

with an additional 250 C/Ku Band installed satellite downlinks

Access to Montana originated C & Ku Band satellite delivered programming

with existing three uplinks and estimated 350 school downlinks

ECONOMICAL Access to Montana Data Networks through state telephone network

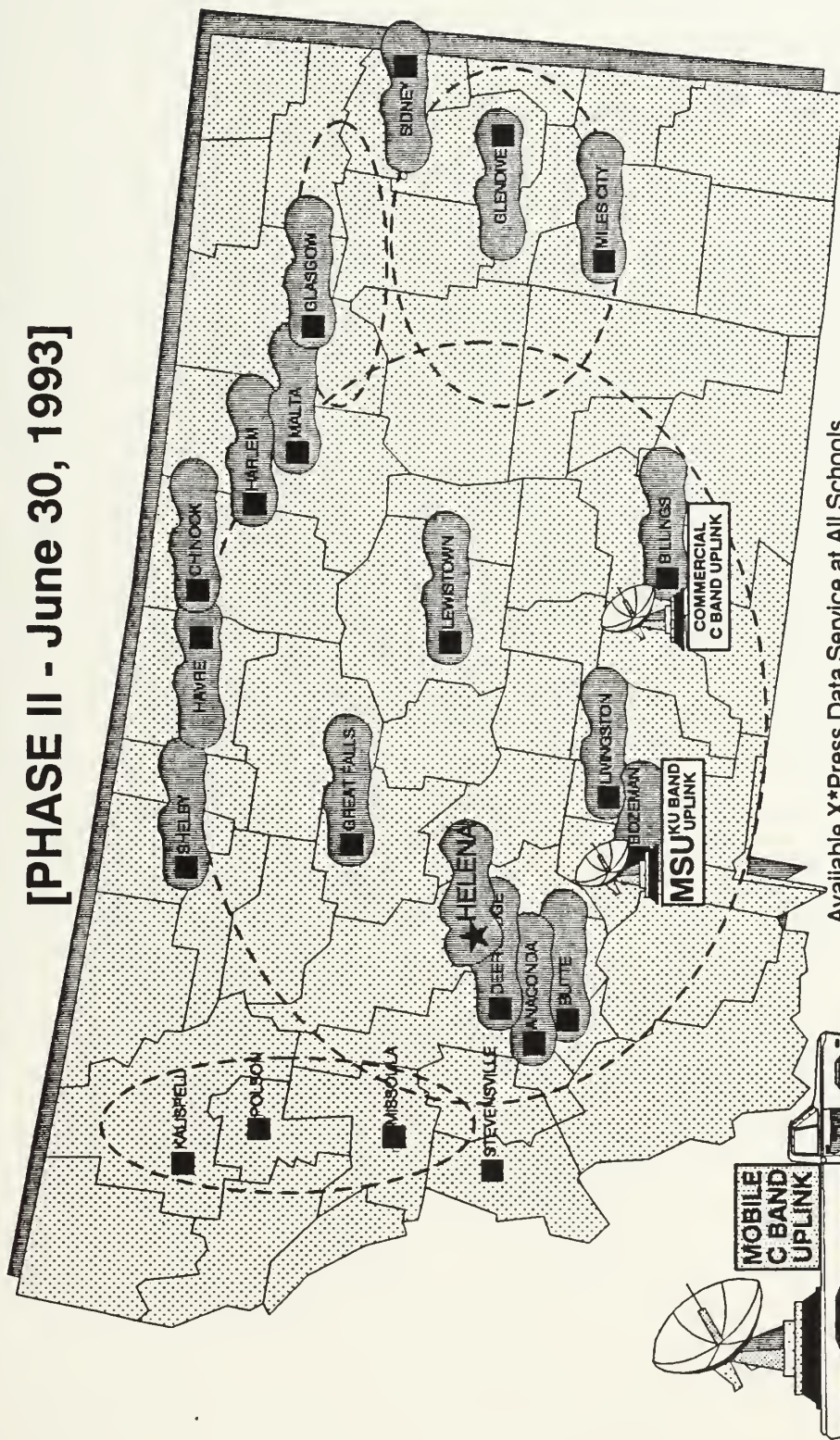
with modems provided for ALL Montana schools

Montana PBS service areas



A MONTANA EDUCATIONAL NETWORK

[PHASE II - June 30, 1993]



**STATEWIDE
COVERAGE**

Regional Interactive Video Projects

Available X*Press Data Service at All Schools

Access to FREE C Band Satellite Transponder Time

Available C Band uplink in Billings with microwave interconnect network

Access to Satellite Delivered Instrucional & Informational Programming

with C/Ku satellite downlinks installed in ALL Montana schools

Access to Montana originated C & Ku Band satellite delivered programming

with existing three uplinks and over 800 downlinks

ECONOMICAL Access to Montana Data Networks thorough state telephone network

with modems provided for ALL Montana schools

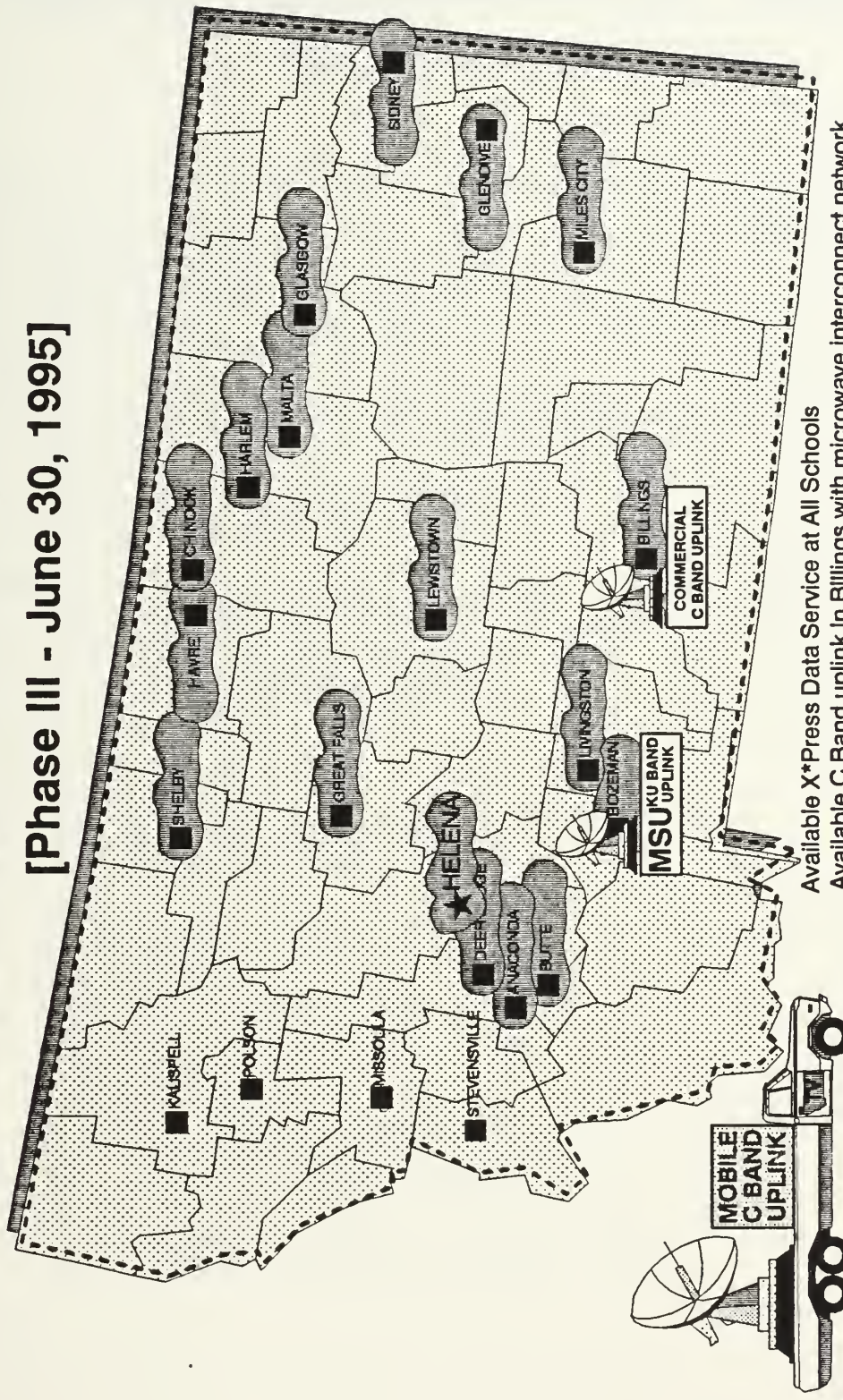
Montana PBS service areas 

Interactive Video Projects expanded to six key sites

in order to interconnect existing Regional Networks

A MONTANA EDUCATIONAL NETWORK

[Phase III - June 30, 1995]



Available X*Press Data Service at All Schools

Available C Band uplink in Billings with microwave interconnect network
Access to Satellite Delivered Instructional & Informational Programming

with C/Ku satellite downlinks installed in ALL Montana schools

Access to Montana originated C & Ku Band satellite delivered programming
with existing three uplinks and over 800 downlinks

ECONOMICAL Access to Montana Data Networks through state telephone network
with modems provided for ALL Montana schools

Montana PBS service areas 

Interactive Video Sites expanded to 66 sites including at least one per county

MONTANA TELECOMMUNICATIONS COOPERATIVE BOARD OF DIRECTORS

Ms. Nancy Keenan Superintendent Office of Public Instruction State Capitol, Room 106 Helena, Montana 59620	Chair
John Hutchinson Acting Commissioner of Higher Education Office of the Commissioner of Higher Education 33 South Last Chance Gulch Helena, Montana 59601	Vice-Chair
Tony Herbert Assistant Administrator of the Information Services Division Department of Administration Mitchell Building, Room 219 Helena, Montana 59620	Secretary/Treasurer
Ms. Claudette Morton Ex. Director Montana Board of Public Education 33 South Last Chance Gulch Helena, Montana 59601	
Mr. Dave Lloyd Forsyth Public Schools P.O. Box 319 Forsyth, Montana 59327	
Mr. Tom Asay Public Interest P.O. Box 914 Forsyth, Montana 59327	
Mr. R.E. "Bob" Saunders, President Montana Public Radio-Television Assoc., Inc. 4574 Highway 12 East White Sulphur Springs, Montana 59645	

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Helena, Montana 59620

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